

REMARKS

Favorable reconsideration of this application is respectfully requested in light of the following remarks.

Claims 1-2 and 5-6 stand rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. As a result, Applicants have amended Claims 1, 2, and 6 to remove the informalities noted by the Examiner. Accordingly, withdrawal of the rejections based on 35 U.S.C. §112, second paragraph, is respectfully requested.

Claims 1-2 and 5-6 stand rejected under 35 U.S.C. §102(b) as being anticipated by GB 849,255 to *Cermak*. In addition, Claims 1-2 and 5-6 have been rejected under 35 U.S.C. §103(a) as being obvious over *Cermak* in view of U.S. Patent No. 5,365,400 to *Ashiwake et al.* Finally, Claims 1-2 and 5-6 stand rejected under 35 U.S.C. §103(a) as being obvious over *Livingood et al.* in view of *Wettstein*.

The Examiner seeks to rely on *Cermak* for teaching each and every element of the claimed invention. However, *Cermak* fails to disclose that troughs are in the form of spherical cups, as conceded by the Examiner. *Cermak* also fails to disclose that the troughs are in the form of similar rotationally symmetrical forms. As discussed in the specification, the troughs defined in the present invention provide an advantage over "known elements having areas running perpendicular to the wall". See page 7, lines 7-10 of the present application.

It appears that the Examiner is attempting to equate the cylindrical pockets of *Cermak* with the spherical cups or other similar rotationally symmetrical formed troughs as defined in independent Claim 1. However, the cylindrical pockets of *Cermak* have side

walls that run perpendicular to the wall. This configuration results in unfavorable flow conditions and non-homogeneous effect on the thermally stressed opposite side of the wall, and therefore, an inhomogeneous temperature distribution on that side, and thermal stresses in the wall. In the field of turbomachines, such stresses are highly unwelcome.

These disadvantages are avoided by providing the surface, facing the impingement jets, with a number of troughs in the form of spherical cups or similar rotationally symmetrical forms, with one impingement jet per trough. Such an arrangement optimizes both the flowing conditions on the impingement side and the temperature distribution on the planar opposite side. As such, *Cermak* fails to disclose the patentable features of independent Claim 1.

The Examiner seeks to rely on *Ashiwake et al.* for disclosing that which is missing from *Cermak*. However, the combination of these two references is not appropriate. In particular, *Ashiwake et al.* relates to the cooling of semiconductors. A plurality of tabular fins are laminated via spacers, having a central through-hole for feeding a cooling fluid and radial passageways between the fins for flowing the cooling fluids in a radial direction, thereby cooling the fins. In every case, the cooling fluid flows through a channel having a spherical curved contour. The reason for the spherical contour is to produce boundary layer instabilities, that cause vertical vortices and to intensify the convective cooling within the channel.

However, *Cermak* and *Ashiwake et al.* are not from the same field of endeavor, and one having ordinary skill in the art would not be motivated to combine the two references in the manner suggested by the Examiner. In particular, *Cermak* relates to the field of

cooling walls of combustion spaces of high thermal stresses, such as combustion chambers, melting chambers and the like. *Ashiwake et al.* relates to the field of cooling of semiconductor chips. These fields are quite different from each other in essential physical parameters, such as temperature, thermal stresses, pressure, mass flows, dimension, materials, and working condition. As such, Applicants submit that one having ordinary skill in the art of combustion chambers would not look to the field of electronic chips for a solution to cooling a wall of combustion spaces. Accordingly, withdrawal of the rejection based on the combination of *Cermak* with *Ashiwake et al.* is respectfully requested.

The Examiner has maintained the rejection of *Livingood et al.* in view of *Wettstein*. For the reasons set forth below, it is submitted that this combination is not appropriate.

Livingood et al. discloses an experimental arrangement for studying the heat transfer characteristics of a *single* turbulent air jet impinging on the concave surface of a hemispherical shell. The Examiner concedes that it comprises a single shell with a constant wall thickness (see Figure 1, section A-A). This experiment is a simulation of impingement cooling of the internal surface of turbine vanes or blades in the leading edge region. This region is characterized by a concave shaped inner surface and a similar shaped outer surface with nearly constant wall thickness. And this concave inner shape of the leading edge is simulated by this experiment for investigating the flow conditions in areas, shaped in such a way.

Livingood et al. does not mention directing a plurality of impingement jets onto a wall with an impingement facing side having a plurality of concave hemispherical surfaces. Likewise, *Livingood et al.* does not disclose an opposed wall having a plane design.

Nevertheless, the Examiner alleges that "these parameters appear to be selected for convenience in the experiment". However, Applicants submit that this conclusion is incorrect. The parameters selected in the *Livingood et al.* study reflect the real facts in the area of the leading edge. A constant wall thickness is a characteristic feature of the shell of *Livingood et al.* and a constant or near constant wall thickness is the characteristic feature of the leading edge of a vane or blade. Therefore, *Livingood et al.* clearly refers to impingement cooling of concave walls, characterized by constant thickness in all areas of the concavity.

The Examiner also alleges that "the heat transfer surface comprises more than a single concavity opposed to a planar surface of the vane blade". However, Applicants submit that this allegation is likewise incorrect. There is only a single concavity opposed to the region of the leading edge of a blade or vane. Moreover, there is no opposed planar surface in this region. Inside of the blade of the leading edge is formed a semicylinder, which longitudinally extends from the foot to the tip of the blade. And the outer wall side is shaped either identically to the inner side or similarly with a thickening in the center. But in no case is there a concavity (or more concavities) with an opposed planar surface.

Moreover, the *Livingood et al.* states that "The results of an experimental study of heat transfer characteristics... compare favorably with a similar correlation for the concave surface of a semispherical shell. Such a favorable comparison substantiates the semicylindrical correlation which is used in the design of turbine vanes and blades". Thus, in contrary to the Examiner's position, the wall thickness was not "selected for convenience", but rather the hemispherical design of the surface was selected to investigate

the heat characteristics of an impinging jet in the real hemicylindrical design of the working environment. The hemispherical design is clearly defined as an exclusive experimental arrangement for simulating a real semicylindrical surface. Accordingly, the Examiner's reliance on *Livingood et al.* is misplaced.

Nevertheless, the Examiner seeks to rely on *Wettstein* for teaching that which is missing from *Livingood et al.* However, *Wettstein* discloses "... the baffle surface of the wall part 10, to be cooled, is designed as a relief, i.e., to have relieved or recessed areas and projecting areas, the jets striking the projected humps. Consequently the non-homogeneous heat transmission in the baffle jets can be compensated and a homogeneous temperature distribution on the hot side of the wall part is achieved." See col. 3, lines 21-27 of *Wettstein*. Therefore, *Wettstein* explicitly teaches, in that case, the wall is designed as a relief, not to direct the jets into the recessed areas, but onto the humps for homogeneous temperature distribution on the opposite planar side. *Wettstein* fails to describe a plurality of spherical troughs with one jet per trough.

As heat transfer is a function of wall thickness, there is a danger of inhomogeneous temperature distribution on the opposed side of the wall. Particularly in modern turbo machines, such as a gas turbine, inhomogeneous temperature distribution is highly unwelcome. Therefore, one having ordinary skill in the art would direct the impingement jets to the areas with the largest wall thickness, and consequently a lower heat transfer, such as the webs of a relief. One having ordinary skill in the art would NOT direct the impingement jets into the deepenings, the point with the smallest wall thickness, and therefore highest heat transfer. *Wettstein* teaches away from directing the impingement jets

into the reliefs. Accordingly, *Livingood et al.* is not properly combinable with *Wettstein*. Therefore, neither *Livingood et al.*, nor *Wettstein*, in combination or alone, teach the features of Claim 1.

It appears the Examiner is reconstructing the claimed invention from selected pieces of prior art without the requisite motivation or suggestion. In particular, it appears that the Examiner is picking and choosing elements from each reference, while discarding specific teachings that don't support his position. However, this is impermissible. The Examiner has failed to provide any motivation to modify or combine the references in the manner suggested by the Examiner. The Examiner can not reconstruct the claimed invention from selected pieces of prior art absent some suggestion, teaching, or motivation in the prior art to do so. *Uniroyal, Inc. v. Rudkin-Riley Corp.*, 5 USPQ2d 1434, 1438 (Fed. Cir. 1999).

In addition, it appears that the Examiner has viewed the instant application as a guide for modifying the cited art. However, it is well established that the use of the application under examination as a guide to modifying the cited art constitutes impermissible hindsight, and may not be used in rejection of the claims. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990). Accordingly, the Examiner has failed to establish a *prima facie* case of obviousness.

For at least the foregoing reasons, it is submitted that the present invention, as defined in independent Claim 1, and the claims depending therefrom, is patentable distinguishable over the applied documents. Accordingly, withdrawal of the rejections of record and allowance of this application are earnestly solicited.

Should any questions arise in connection with this application, or should the Examiner believe that a telephone conference with the undersigned would be helpful in resolving any remaining issues pertaining to this application, the undersigned respectfully requests that she be contacted at the number indicated below.

Respectfully submitted,

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Date: December 12, 2002

Mark-up to Amendment dated December 12, 2002

Marked-up Claims 1, 2, and 6

1 1. (Twice Amended) An impingement flow for a wall part, in which a
2 plurality of impingement orifices are arranged areally in a plane or curved carrier, the
3 carrier being arranged at a distance from the wall part, and [the] an impingement area, to
4 be cooled or heated, of the wall part being designed as a relief, wherein

5 - that side of the wall part which faces the impingement jet is provided with a
6 number of troughs arranged next to one another, said troughs being in the form of
7 spherical cups or similar rotationally symmetrical forms, one impingement jet per trough
8 being provided, which impingement jet strikes [the] a trough base at least approximately
9 perpendicularly, and

10 - that side of the wall part which is remote from the impingement jet is of at
11 least roughly plane design.

1 2. (Twice Amended) The impingement flow as claimed in claim 1, wherein the
2 trough has the shape of a circle segment [or of a base area related thereto].

1 6. (Twice Amended) The impingement flow as claimed in claim 1, wherein the
2 impingement orifices form the inlet of impingement tubes, [the] a mouth of which is
3 directed toward the wall part to be cooled or heated.